Research History : P.R. Page

THEORETICAL NUCLEAR PHYSICS

Used nuclear quantum mechanical scattering theory to fit experimental data on cross-sections of light nuclei using partial wave analysis in terms of resonances:

- Built a database of experimental data.
- Did nuclear cross-section evaluation for the ^{8}Be, ^{11}C and ^{14}N systems, spanning about 21 nuclear reactions leading to these nuclei. The analysis for most of these systems involved the strong interaction, but for ^{14}N it involved the electromagnetic interaction.
- Provided evaluated nuclear cross-section files for all these systems.
- Calculated temperature-dependent thermonuclear reaction rates for ^{8}Be and ^{11}C.

Analysed fits and investigated scattering theory and computation:

- Calculated the scattering matrix, which was used to calculate the pole structure (energies and decay times) of the different resonances in the spectrum of ^{8}Be.
- Developed the theory by deriving an additional mathematical term and constructing the formalism needed for calculations involving multiple reactions.
- Previously, the theory was restricted to the reaction of *two* nuclei (bodies). Modelled three-body reactions as quasi-two-body reactions, which were incorporated as additions to the computer program, so that three-body experimental data can be analysed.

THEORETICAL ELEMENTARY PARTICLE (HADRONIC) PHYSICS

Research for postdoctoral positions:

- Discovered of a new category of vanishing strong interaction decays which is more general than specific models. Completely rigorous and general derivation of these vanishing decays in quantum field theory.
- Particle systems built purely from interacting gluons.
- Systems with three quarks and either an excited gluon interaction or an additional quark-antiquark pair.
- Applied heavy quark symmetry to mesons made from one light and one heavy quark; and an approximate spin symmetry in these mesons, related to the pseudospin symmetry found in large nuclei.
- Speculative interpretation of the nature of resonances contained in new experimental data.

Research for academic degrees:

- **M.Sc.** : Calculated Feynman loop diagrams in quantum field theory for neutrons using special mathematical functions.

- **Ph.D.** : Concerned with the possible existence of particles (resonances) that had not yet been detected, called *hybrid mesons*. A hybrid meson forms if a quark-antiquark pair (called a *meson*) experiences an excited gluon (photon-like) interaction.
  - Calculated in a quantum mechanical flux-tube model of bound states.
  - Purely analytical calculation of statistical decay probabilities for both strong and electromagnetic interactions using rotation functions and angular momentum coupling.

Equations solved:
- Two-, three- and multi-body Schrödinger equation (a diffusion-type equation); as well as the more complicated Dirac and Bethe-Salpeter equations.

OTHER

- **Bioinformatics:** Performed summer school research on gene expression data in 2000.
- Vacation work involving computational numerical methods in nuclear fusion (magnetohydrodynamics in **plasmas**) and fission (**radiation transport**) during 1988-89.